

RISK OF VISUAL IMPAIRMENT AND INTRACRANIAL HYPERTENSION AFTER SPACE FLIGHT: EVALUATION OF THE ROLE OF POLYMORPHISM OF ENZYMES INVOLVED IN ONE-CARBON METABOLISM

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Data from the Nutritional Status Assessment protocol provided biochemical evidence that the one-carbon metabolic pathway may be altered in individuals experiencing vision-related issues during and after space flight (1, 2). Briefly, serum concentrations of homocysteine, cystathionine, 2-methylcitric acid, and methylmalonic acid were significantly ($P<0.001$) higher (25-45%) in astronauts with ophthalmic changes than in those without such changes (1). These differences existed before, during, and after flight. Serum folate was lower ($P<0.01$) during flight in individuals with ophthalmic changes. Preflight serum concentrations of cystathionine and 2-methylcitric acid, and mean in-flight serum folate, were significantly ($P<0.05$) correlated with postflight changes in refraction (1).

A follow-up study was conducted to evaluate a small number of known polymorphisms of enzymes in the one-carbon pathway, and to evaluate how these relate to vision and other medical aspects of the eye. Specifically, we investigated 5 polymorphisms in MTRR, MTHFR, SHMT, and CBS genes and their association with ophthalmic changes after flight in 49 astronauts. The number of G alleles of MTRR 66 and C alleles of SHMT1 1420 both contributed to the odds of visual disturbances (3). Block regression showed that B-vitamin status at landing and genetics were significant predictors for many of the ophthalmic outcomes studied (3). In conclusion, we document an association between MTRR 66 and SHMT1 1420 polymorphisms and space flight-induced vision changes.

These data document that individuals with an altered 1-carbon metabolic pathway may be predisposed to anatomic and/or physiologic changes that render them susceptible to ophthalmic damage during space flight.

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